

RESOURCE MANAGEMENT PLAN

4(d) RULE EVALUATION AND RECOMMENDED DETERMINATION:

Puget Sound Comprehensive Chinook Management Plan:
Harvest Management Component

provided by

Washington Department of Fish and Wildlife and the Puget Sound Treaty Tribes

April 19, 2001

Attachment 1

4(d) RULE EVALUATION AND RECOMMENDED DETERMINATION

TITLE OF RMP:	Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component
RMP PROVIDED BY:	Washington Department of Fish and Wildlife Puget Sound Treaty Tribes
FISHERIES OR AREA:	PFMC and Puget Sound fisheries potentially affecting listed Puget Sound chinook salmon
ESU:	Puget Sound chinook salmon
4(D) RULE LIMIT:	Limit 6
TRACKING NUMBER:	NWR/4d/6/2001/002
DATE:	April 19, 2001

BACKGROUND

National Marine Fisheries Service (NMFS) issued a final Endangered Species Act (ESA) 4(d) rule adopting regulations necessary and advisable to conserve Puget Sound chinook salmon (July 10, 2000, 65 FRN 42422). ESA section 9 take prohibitions do not apply to fisheries that are managed in accordance with a state/tribal jointly developed resource management plan (RMP) that is consistent with the ESA 4(d) rule criteria. The Washington Department of Fisheries and the Puget Sound Treaty Tribes (hereafter referred to as “Co-managers”) have provided NMFS a RMP for Puget Sound fisheries that will affect listed Puget Sound chinook salmon. The proposed RMP provides a framework through which the state and tribal jurisdiction can jointly managed salmon fisheries while meeting conservation requirements specified under the ESA. The Co-managers have provided the RMP for review and determination by NMFS that it adequately addresses the criteria of Limit 6 of the 4(d) rule, thereby exempting those fisheries operating consistent with the RMP from section 9 take prohibitions.

EVALUATION

The Final 4(d) Rule for the Puget Sound Chinook Evolutionarily Significant Unit (ESU) states that the prohibitions of paragraph (a) of the rule (16 U.S.C. 1531-1543) do not apply to actions taken in compliance with a resource management plan (RMP) jointly developed by the States of Washington, Oregon and/or Idaho and the Tribes, provided that the following elements of the rule are met:

- (6)(i)** 1. The Secretary has determined pursuant to 50 CFR 223.209 [Tribal 4(d) Rule] and the government-to-government processes therein that implementing and enforcing the joint tribal/state plan will not appreciably reduce the likelihood of survival and recovery of affected threatened ESUs.
2. In making that determination for a RMP, the Secretary has taken comment on how any fishery management plan addresses the criteria in §223.203(b)(4) of the 4(d) rule.

As per the Tribal 4(d) Rule, NMFS consulted regularly with the Puget Sound Treaty Tribes during the development of the RMP through government to government meetings and technical workshops. These occasions provided the opportunity to provide technical assistance, exchange information and discuss what would be needed to provide for the conservation of the listed species and to be consistent with legally enforceable tribal rights and with the Secretary's trust responsibilities to the tribes.

The following is an evaluation of whether the RMP adequately addresses the criteria specified in §223.203(b)(4)(i), as referenced under Limit 6 of the final 4(d) Rule for Puget Sound chinook salmon (July 10, 2000; 65 FRN 42422).

Limit to Take Prohibitions Criteria and RMP Evaluation

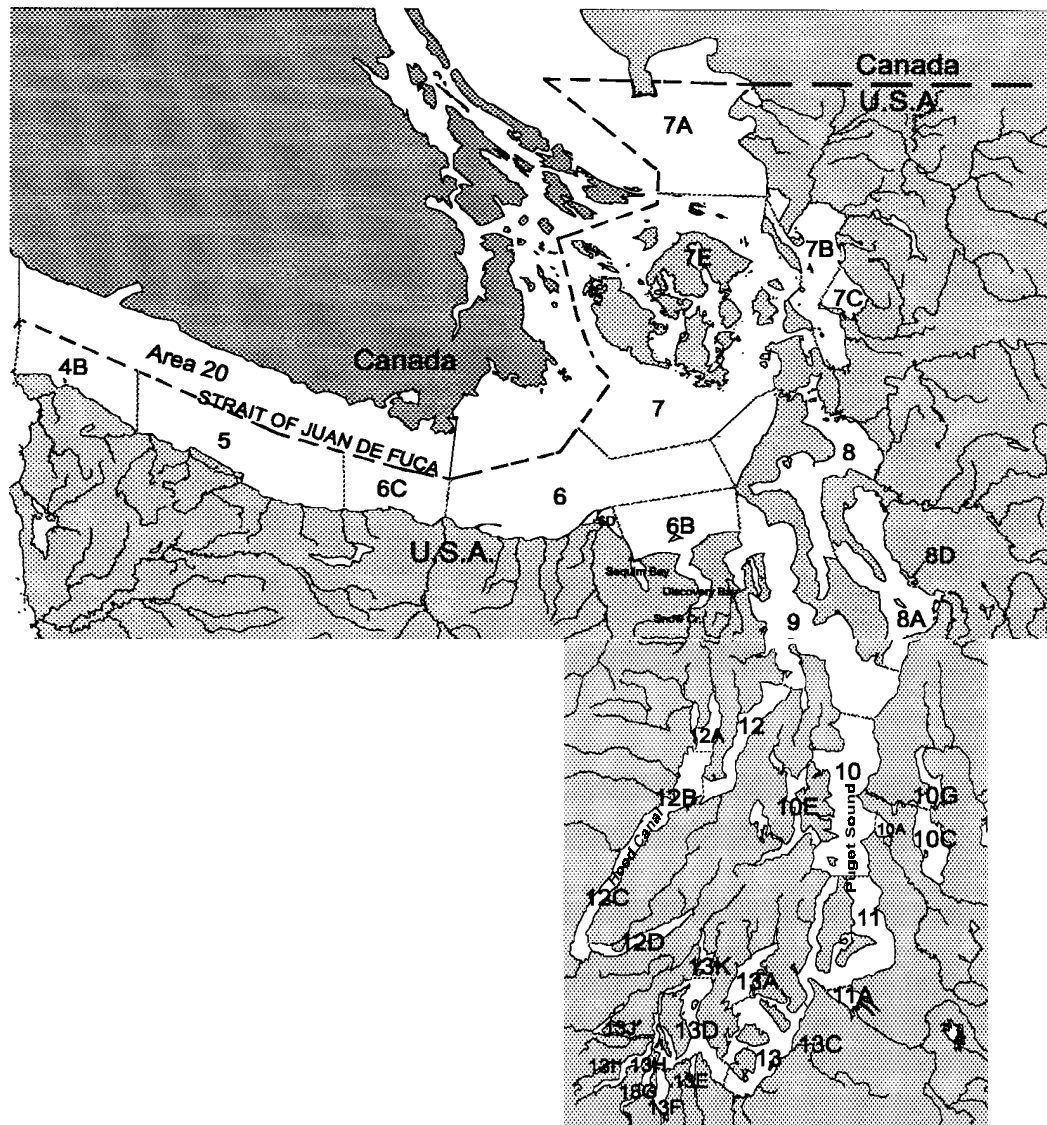
(4)(i) Clearly defines its intended scope and area of impact;

This management plan defines harvest objectives for chinook salmon originating in Washington waters from the mouth of the Strait of Juan de Fuca eastward (Puget Sound). This geographic scope encompasses the area defined by the Puget Sound chinook salmon ESU, as established by NMFS (Myers et al. 1998), as well as the western Strait of Juan de Fuca. Harvest objectives specified in this plan account for fisheries-related mortality throughout the migratory range of Puget Sound chinook, from Oregon to Southeast Alaska.

The goals and objectives outlined within this plan guide the management of Puget Sound chinook as they transit various management jurisdictions. Intercepting fisheries in Alaska and British Columbia are managed in compliance with the Pacific Salmon Treaty (PST) (PST 1999). Ocean fisheries off the coasts of Washington and Oregon are managed in compliance with the

Magnuson-Stevens Act (1996) by the Secretary of Commerce. The State of Washington and treaty Indian tribes manage fisheries within Puget Sound pursuant to the Puget Sound Salmon Management Plan (PSSMP 1985).

Figure 1. Map of area encompassed by the Puget Sound chinook RMP.



(4)(i) Sets forth the management objectives and the performance indicators for the plan;

The Puget Sound Chinook RMP states that:

“It is the goal of the Parties to protect, restore, and enhance the productivity, abundance, and diversity of Puget Sound chinook salmon and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries, non-consumptive fish benefits and other cultural and ecological values. Achievement of this goal requires that harvest be constrained within limits appropriate to the productivity of each stock. Harvest management must work in concert with habitat protection and restoration, as well as artificial production, in order to attain the necessary spawners and rates of recruits per spawner to achieve this goal.

Ultimately, success of the Comprehensive Chinook Management Plan includes restoring populations to levels that provide meaningful harvest on a sustained basis. In the near term, as comprehensive recovery activities in habitat and hatcheries are being implemented, fisheries will be managed to ensure that mortalities (catch and incidental) will not impede progress toward recovery.”

In addition, the plan is driven by a set of general principles:

- All individual populations of chinook must be considered in assessing the achievement of the plan’s objective. Populations may be combined into management units for the assessment of impacts.
- All sources of fishing- related mortality, including landed and non-landed, incidental and directed, are included in assessing total exploitation rates. All fishing-related mortality will be expressed in terms of adult equivalent fishing-related mortality.
- Harvest management will consider size, age or sex selectivity in fisheries to maintain or restore the diversity and productivity of chinook populations.
- Conservation actions shall be shared fairly.
- This plan shall comply with U.S. v. Washington (384 F. Supp. 312 (W. D. WASH. 1974)) and other applicable federal court orders.
- The plan shall be updated and modified as additional information becomes available and outcomes of management measures are evaluated against expectations. Because success of this management plan will require improving knowledge regarding the productivity of the populations and capacity of habitat for chinook salmon.

Management unit¹ specific objectives are summarized in Table 1 and more fully in section IV and Appendix A of the Puget Sound chinook RMP. These management objectives are comprised of exploitation rate ceilings and escapement thresholds for each Management unit within Puget Sound, designed in total to not impede recovery of chinook in Puget Sound including the Western Strait of Juan de Fuca.

Performance indicators for the management actions in the Puget Sound chinook RMP consist of population, fishery and sampling indicators. The population indicators include assessing run size abundance, spawning escapements and coded-wire tag based estimates of exploitation rate for each management unit and population in Puget Sound. Spawning ground surveys will be conducted in the streams where chinook occur over the length of the spawn timing (see Appendix D of RMP). Spawning escapements for Puget Sound populations are estimated from surveys of index reaches in each river system. A variety of computational methods are used to calculate escapement, including cumulative redd counts, peak counts of live adults, cumulative carcass counts, and integration under escapement curves drawn from a series of live fish or redd counts.

Performance indicators also include indicators for monitoring fisheries. The primary performance indicators for Puget Sound chinook fisheries are estimates of exploitation rates obtained from coded-wire tags recovered from fisheries and spawning grounds. Secondary fishery indicators include catch and catch rate, fishing effort, non-landed fishing-related mortality, and catch composition (size, age, mark rates, coded-wire tags (CWT), etc.). This information is obtained for sport fisheries through creel surveys and spot check programs, and annual catch record card data from voluntary catch record card returns, and for commercial fisheries from catch sales receipts. Catch composition is obtained by sub-sampling a portion of the catch at commercial fish buyer sites and creel surveys at boat ramps. This information is generally compiled post-season except for certain chinook fisheries that are limited by catch quotas such as the ocean troll and sport fisheries.

Sampling indicators consist of target sample sizes and catch sampling rates for sport and commercial fisheries stratified by area. The recreational fishery baseline sampling program provides auxiliary data for the Salmon Catch Record Card System: species composition to estimate recreational harvest by species and CPUE (salmon per angler trip) to estimate total effort. The baseline sampling program is geographically stratified among Areas 5-13 in Puget Sound. Sampling size is set at 120 fish per stratum for estimation of species composition and 100 boats per stratum for the estimation of CPUE. Commercial and recreational catch in all marine fishing areas in Washington are sampled to recover coded-wire tagged chinook. For commercial fisheries, the objective is to sample at least 20% of the catch in each statistical week, throughout

¹ “A stock or group of stocks which are aggregated for the purpose of achieving a management objective” (Puget Sound Chinook RMP)

the fishing season. For recreational fisheries, the objective is to sample 10% of the catch in monthly strata.

Table 1- Natural Chinook Management Units and Associated Objectives

Natural Chinook Management Units	Recovery Exploitation Rate Ceiling¹	Low Abundance Threshold²
Western Strait Hoko	10% SUS ER ³	500 spawners (c)
Elwha River	10% SUS ER ³	1,000 spawners (c)
Dungeness	10% SUS ER ³	500 spawners (c)
Mid-Hood Canal	15% pre-terminal SUS ER ³ Terminal – 750 spawners	400 spawners (n)
Skokomish	15% pre-terminal SUS ER Terminal – 3,150 spawners/1,200 natural spawners	1,300 spawners/800 natural spawners (c)
Nooksack Early North Fork South Fork	The Co-managers and NMFS are developing a RER assessment for this stock ⁴	1,000 spawners (n) 1,000 spawners (n)
Skagit Spring Chinook	42% Total ER	576 spawners (n)
Skagit Summer/Fall Chinook	52% Total ER	4,800 spawners (n)
Stillaguamish Summer/Fall	25% Total ER	500 spawners (n)
Snohomish Summer/Fall	32% Total ER	2,000 spawners (n)
Lake Washington Chinook Cedar River Index	15% pre-terminal SUS ER Terminal – 1,200 spawners	200 spawners (n)
Green River Chinook	15% pre-terminal SUS ER Terminal – 5,800 spawners	1,800 spawners (c)
White River Spring Chinook	17% Total ER	200 spawners (c)
Puyallup River Chinook	50% Total ER	500 spawners (c)
Nisqually River Chinook	1,100 spawners	500 spawners (c)

(n) – low abundance measures as natural origin recruits.

(c) - low abundance measures as composite escapement of natural and hatchery returns

1/ Interim management ceiling during recovery phase as estimated by the Fishery Regulation and Assessment Model (FRAM).

2/ Level of forecasted spawning abundance that triggers additional management action. Thresholds are set with consideration to stock-specific characteristics and genetic viability concerns.

3/ FRAM exploitation rate measured as total exploitation rate in southern U.S. fisheries. This objective represents the average exploitation rate by southern United States fisheries during 1992-1996 determined from run reconstruction.

4/ In the interim, management guidance will be derived from Appendix C application.

4(i)(A) Defines populations within affected ESUs, taking into account: spatial and temporal distribution genetic and phenotypic diversity, and other appropriate identifiably unique biological and life history traits.

The RMP identifies fifteen management units representing twenty-eight populations that currently support varying degrees of natural production (Table 2). Management units represent the lowest level of population structure that possess comparable demographic data across the region and is the level at which impact modeling occurs for the purpose of harvest management planning. The management units generally include populations within river systems or regions that share similar phenotypic, geographic, and habitat characteristics. In combination, the management units represent the full complement of the natural chinook populations within Puget Sound and include all principal life history traits (spring, summer and fall runs).

Population designations are based on the Salmon and Steelhead Stock Inventory and Assessment (SASSI)(WDFW et al 1993) which identified populations based on differences in biological characteristics, genetic similarity, life history traits and geographic separation. The populations in the RMP correspond to the stocks described in SASSI with two differences: (1) they exclude non-native, or introduced, populations; and (2) recognizes four Hood Canal chinook populations (Duckabush, Dosewallips, Hamma Hamma and Skokomish) rather than the single population defined in SASSI. However, it is not certain that these populations are in fact independent populations. The Puget Sound and Olympic Peninsula Technical Recovery Team (TRT) is currently delineating the population structure of Puget Sound chinook as an initial step in a formal recovery planning effort that is now underway. Until that assessment is completed, SASSI stocks represent the greatest likely level of potential stratification (M. Ruckelshaus, NWFSC/NMFS, pers. com. to S. Bishop, NMFS, January 30, 2001). By considering at this time the status of the stocks as described by WDF et al., we can be reasonably certain that population structures that may be important to the ESU have not been overlooked. However, these population designations should be considered preliminary and may be revised based on additional information and/or the findings from the TRT efforts.

The Nooksack early, Skagit spring, Skagit summer/fall, Snohomish summer/fall, Stillaguamish summer/fall, Lake Washington, Green and Hood Canal management units comprise multiple populations. Populations have been aggregated in the case of these Management units for several reasons: (1) information is currently insufficient to derive population-specific objectives; (2) there is no information suggesting the populations are exploited unequally in mixed-stock fisheries, and none have discrete extreme terminal areas where they could be harvested independently; (3) the populations are similar in migration timing, catch distribution or productivity such that harvest objectives should also be similar; and, (4) objectives have been derived for each population in the aggregate and the management unit as a whole is managed to achieve them. The management units and/or management unit objectives may be revised with

new information. Detailed discussion of the population structure of Puget Sound chinook can be found in Sections I and VI, and Appendix A of the Puget Sound chinook RMP.

Puget Sound chinook populations can be categorized according to the character and history of chinook production in the system. This stratification provides a context for analyzing actions and considering recovery efforts. The stratification assigns stocks to one of three categories

Category 1 stocks are genetically unique and indigenous to watersheds of Puget Sound. Maintaining genetic diversity and integrity, and achieving abundance levels for long-term sustainability are the highest priorities for these populations. The objective for Category 1 populations is to protect and recover these indigenous populations. The intent is to rebuild and manage for natural origin recruits (NORs). Fisheries are managed to meet escapement goal and exploitation rates based on our current understanding of natural chinook production requirements for these populations. Nineteen populations have been identified in this category (Table 3).

The status of Category 1 populations varies. Some populations (Dungeness and Nooksack) have fallen to such low levels that the ability to maintain their genetic diversity may be at risk. Other populations are more robust and the abundance levels are above what is needed to sustain genetic diversity, but often not at levels that will sustain maximum yield harvest rates. All of these populations have natural spawning escapement goals, which are actively managed for, but have not generally been achieved in recent years. In some cases (Elwha, Dungeness, Nooksack, Stillaguamish, and White River) hatchery operations are essential for recovery, and without them, the populations would likely further decline and become extinct. In one case at least (Green River) the number of local-origin hatchery fish spawning naturally is a concern, in part because it masks our ability to evaluate the actual productivity of natural fish.

Category 2 populations are located in watersheds where indigenous populations may no longer exist, but where sustainable populations existed in the past, and natural production is possible given suitable or productive habitat. The level of natural spawning in these streams may largely reflect production and escapement of hatchery fish. The objective for Category 2 populations is to use the most locally-adaptable population to reestablish naturally-sustainable populations. Fisheries are managed to meet escapement goals and exploitation rates based on achieving specified levels of spawning adults. Six populations have been identified in this category (Table 3).

Category 2 populations are primarily found in Hood Canal and South Puget Sound where hatchery production has been used to mitigate for natural production lost to habitat degradation. Consequently, these areas have been managed for hatchery production for many years. Populations have been preliminarily assigned to Category 2 based on current information, but further investigations by NMFS and the Co-managers will seek to identify remnant indigenous populations which, if found, may cause them to be reassigned to Category 1.

Category 3 populations are generally found in small independent tributaries of Puget Sound that may now have some natural spawning, but never had independent, self-sustaining populations of chinook salmon. Many of these watersheds do not have the morphological characteristics needed for chinook and may be better suited for coho and chum salmon, cutthroat trout or resident species. Chinook salmon that are observed occasionally in these watersheds are primarily the result on-going annual hatchery chinook releases into the watersheds and/or straying from other systems. Since these populations have not historically supported established chinook populations, fisheries are not managed to achieve any specified level of natural escapement for these populations. In addition, there is no attempt to limit or segregate hatchery or natural origin recruits. However, fisheries will also be managed so as not to compromise the use of these areas by chinook as they have used them historically, i.e., as refugia, or marginal habitat in years of high abundance.

Category 3 populations are primarily located in areas of deep South Puget Sound, western Puget Sound. They have been managed for hatchery chinook production, or natural production objectives for other salmon species originating from these areas. One SASSI stocks has been identified in this category (Table 3).

Based on this framework, Category 1 and 2 populations are therefore the core populations that provide the focus for the analysis of the Puget Sound RMP. Category 2 populations occur in watersheds where indigenous populations no longer exist and the habitat has been significantly degraded. In these systems hatchery and natural fish are inseparable on the spawning grounds. Mass marking programs are underway to mark hatchery fish so that they can be separated, but it will be several years before the information can be used to determine natural production. Given the conditions of these watersheds, the goal of management will be to provide sufficient escapement to the spawning grounds to maximize whatever productivity there is. Future decisions regarding the form and timing of recovery efforts in these watersheds will dictate the kinds of harvest actions that may be necessary and appropriate.

Fishing-related mortality of Puget Sound fisheries on the Hood Canal Summer-Run Chum Salmon ESU, the other listed ESU in Puget Sound, are being addressed in another RMP developed by the Co-managers and is currently under evaluation by NMFS for consistency with Limit 6. Other ESUs transiting Puget Sound areas are either not affected by the fisheries included in the RMP or fishing-related mortality will be addressed in other RMPs, FMEPs, or ESA section 7 consultations. These ESUs include Snake River steelhead, fall chinook, summer chinook, and sockeye salmon, Upper Columbia steelhead, Middle Columbia steelhead, Upper Willamette steelhead and chinook, Lower Columbia chinook and steelhead, and Columbia River chum salmon. Fishing-related mortality on these ESUs have also been addressed in previous section 7 consultations (NMFS 1999, NMFS 2000b).

Table 2 – Natural Chinook Management Units

Management Unit	Populations
Nooksack Early	North Fork Nooksack*, South Fork Nooksack
Skagit Spring	Upper Sauk, Suiattle, Upper Cascade
Skagit Summer/Fall	Upper Skagit summer, Lower Sauk summer, Lower Skagit fall
Stillaguamish Summer/Fall	Stillaguamish summer*, Stillaguamish fall
Snohomish Summer/Fall	Snohomish summer, Wallace River summer/fall, Snohomish fall, Bridal Veil Creek fall
Lake Washington Summer/Fall	North Lake Washington Tribs., Cedar River
Green Summer/Fall	Green, Newaukum Creek
White River Spring	White River spring*
Puyallup River	Puyallup River fall
Nisqually River Summer/Fall	Nisqually summer/fall
Mid Hood Canal	Dosewallips, Duckabush, Hamma Hamma
Skokomish River	Skokomish natural/hatchery
Dungeness	Dungeness*
Elwha	Elwha*
Western Strait	Hoko

* Includes hatchery program listed as essential to recovery

Table 3. SASSI stocks by recovery category. Stock timing designations are spring (SP), summer (S), fall (F), and summer/fall (SF).

Region	Management Unit	SASSI Stock/Timing	Recovery Category
Strait of Juan de Fuca	Hoko River	Hoko/F	1
	Elwha River	Elwha/Morse Cr./SF	1
	Dungeness River	Dungeness/SP	1
Hood Canal	Mid-Hood Canal	Hood Canal/SF	2
	Skokomish River		2
North Sound	Nooksack Early	NF Nooksack/SP	1
		SF Nooksack/SP	1
	Skagit Spring	Upper Sauk/SP	1
		Suiattle/SP	1
		Cascade/SP	1
	Skagit Summer/Fall	Upper Skagit/S	1
		Lower Skagit/F	1
		Lower Sauk/S	1
Mid-Sound	Lake Washington	N Lake WA Tribs/SF	2
		Cedar/SF	1
	Green River	Duwamish/Green/SF	1
		Newaukum Cr/SF	= Green River
South Sound	White River Spring	White River/SP	1
	Puyallup	Puyallup River /SF	2
	Nisqually	Nisqually River/SF	2
	South Sound Tribs	South Sound Tribs/SF	3

(B) Uses the concepts of “viable” and “critical” salmonid population thresholds, consistent with Viable Salmonid Populations (VSP) concepts in “Viable Salmonid Population” (NMFS 2000a)

The regulations in the 4(d) Rule state an RMP must use the concepts of “viable” and “critical” thresholds in a manner so that fishery management actions; (1) recognize significant differences in risk associated with viable and critical population threshold states, and (2) respond accordingly to minimize long-term risks to population persistence. Harvest actions that impact populations or management units currently at or above their viable thresholds must maintain those populations or management units at or above those threshold levels. Fishing-related mortality on populations or management units above critical threshold levels but not at viable threshold levels (demonstrated with high degree of confidence) must not appreciably slow achievement to viable function. Fishing-related mortality to populations or management units functioning at or below critical threshold must not appreciably increase genetic and demographic risks facing the population or management unit and must be designed to permit achievement of viable functions, unless the RMP demonstrates the likelihood of survival and recovery of entire ESU in the wild would not be appreciably reduced by greater risks to an individual population.

The objectives in the RMP differ in terminology from those in the 4(d) Rule. Viable and critical thresholds are defined in the VSP document (McElhaney *et al.* 2000). They are used by NMFS to assess viability for the purposes of ESA. The Co-managers have established corresponding thresholds as management objectives termed low escapement and spawning escapement and long-term escapement thresholds. In general these incorporate objectives in addition to viability in their derivation. For example, they may be designed to produce a specific level of harvest, or more fully occupy the available habitat. The long-term abundance thresholds correspond with the escapement goals established under the Puget Sound Salmon Management Plan and are used to assess progress toward recovery until formal recovery goals are established. Spawning escapement thresholds in Table 4 were used to derive exploitation rate objectives, and are based on current estimates of survival, productivity and habitat capacity where available. For some management units, the spawning escapement thresholds and long-term escapement thresholds are identical. The low escapement, spawning escapement and long-term escapement thresholds must be consistent with the concepts of viable and critical thresholds as contained in the VSP document.

The RMP establishes spawning escapement thresholds for all of the Category 1 and 2 management units, and eleven of the twenty-four individual populations where the Co-managers determined sufficient data was available (Table 4). These thresholds were primarily based on estimates of Maximum Sustained Yield (MSY) escapement. NMFS derived viable thresholds for seven more populations where it determined data was sufficient (Table 5). The use of MSY escapement is conservative in that it is the point of maximum surplus above 1:1 spawner replacement. Low abundance thresholds were established for all Category 1 and 2 Puget Sound

chinook populations where information was available (Table 4). These thresholds trigger additional management actions, and meet or significantly exceed the general guidance in VSP. This was done to safeguard populations from declining to the point of instability, recognizing the uncertainties inherent in harvest management. NMFS derived critical escapement thresholds for the same populations (Table 5). In general, the RMP provides a conservative approach to setting critical and viable thresholds. Sections III, IV and Appendix C of the RMP describe the management approach in more detail. Currently, the majority of the management units have positive escapement trends and several are routinely meeting or exceeding their long-term spawning escapement goals.

The harvest regime specified in the RMP will take into account the different risks facing a population depending on the status of the population (i.e. critical or viable state). The basic harvest management strategy is to keep exploitation rates at or below a management unit-specific ceiling rate, as long as the unit's spawning escapement is expected to be above the low abundance threshold. Over a 25 year period under current environmental conditions, the exploitation rate objectives for each management unit are expected to result in an 80% probability or greater of achieving the spawning escapement threshold and a 5% probability or less of falling below the low escapement threshold, when compared against the probabilities of achieving these thresholds with zero fishing. Exploitation rates of this type have been developed for a subset of the management units, and will be developed for the remaining management units over the next several years, or as data becomes available.

In the interim, for those management unit where work has not been completed, or data is not available, exploitation rates are designed to stabilize, and where possible increase, escapements. If one of the populations drops below or is forecast to drop below its critical threshold, fishing-related mortality will be reduced even further. For populations currently below their low escapement thresholds, fishing-related mortality in Southern US waters been reduced to extremely low levels (4-15%). The RMP would keep Southern US fisheries for these management units at these low levels. Total exploitation rates have been stable at low levels in recent years, although variable due to internal Canadian conservation issues. In the near-term, these management actions are expected to continue in Canadian fisheries and maintain the levels of exploitation rates that have resulted in the current positive escapement trends for these units. For domestic management purposes, constraining fishing-related mortality to incidental levels is prudent.

NMFS' VSP document (2000a) describes four key parameters for evaluating the status of salmonid populations. These parameters are population size (abundance), population growth rate (productivity), spatial structure, and diversity. The Puget Sound RMP designated low escapement, spawning escapement and long term spawning escapement thresholds to correspond with the critical and viable thresholds for each management unit. These thresholds were designated as preliminary because biological information is limited. The thresholds may be

revised in the future based on further information and recovery planning efforts by the TRT. This approach is consistent with the guidelines provided in the VSP technical document (NMFS 2000a; see page 30). Below is a discussion of the consistency of the RMP with the concepts in the VSP document.

Population Size

The RMP reflects a variety of methods used to derive the long-term, spawning and low escapement thresholds for Puget Sound chinook populations. Long-term escapement thresholds in the RMP represent (1) established MSY escapement goals agreed to under the PSSMP; (2) MSY escapement consistent with current conditions; or, (3) the escapement for which there is a 1% probability of extinction at the end of 100 years under current conditions. Low escapement thresholds were established to avoid stock instability and generally represent: (1) the lowest escapement with a positive return; (2) the escapement for which there is 5% probability of extinction at the end of ten years; or, (3) generic VSP guidelines (NMFS 2000a). The method chosen depended on the quality and quantity of population-specific data available.

Low escapement thresholds were established for all management units and Puget Sound chinook populations where natural production occurs, except Skagit spring chinook. The Co-managers cited lack of data for the individual Skagit spring populations. Spawning escapement thresholds were established for all management units and eleven of the twenty-four Puget Sound chinook populations where natural production occurs (Table 4). Spawning escapement thresholds were not established for individual populations for the Skagit spring, Skagit summer/fall, Stillaguamish or Snohomish Management units. In the case of the Stillaguamish and Snohomish Management units, the Co-managers cited a lack of information. In the case of the Skagit Management units², the Co-managers' approach is to manage for the Management unit as a whole, and establish low escapement thresholds to prevent escapement of any component of the Management unit from falling too low.

Appendix A of the RMP describes the specific methods used to derive thresholds for chinook management units and their associated populations in Puget Sound.

Guidance from the existing VSP paper suggests that effective population sizes of less than 500-5,000 per generation are at increased risk (NMFS 2000a). The population size range per generation was converted to an annual spawner abundance range of 125-1,250 by dividing by four, which is the approximate generation length of Puget Sound chinook. The VSP paper also

² For the Skagit Management units, the recovery level is lower than the low abundance threshold which is intuitively inconsistent. However the thresholds are designed to address different levels of uncertainty. The low abundance threshold is the answer to the question: if your preseason forecast was this low, would there be an unacceptable risk of actually getting an escapement less than a critical level? The recovery level answers this question: if your actually-observed escapement was this low in year 1, and conditions stayed the same, would there be an unacceptable risk of the run going extinct in 100 years? The uncertainty in a preseason expectation is much higher than the uncertainty associated with an observed result. Added conservatism was built into the low abundance threshold to minimize the chances of escapements getting this low due to forecast and management error.

suggested that population sizes of 5,000-16,700 were robust against most sources of risk. Using the same average generation length of 4 years, the annual spawner range would be 1,250-4,175 spawners. Where the thresholds fall within these ranges depend on the characteristics of the populations themselves. For example, the interim escapement objectives for the Nooksack populations are 2,000 fish each. Critical threshold values much larger than 200 would be out of context for this population.

In 1999 and 2000, NMFS derived viable and critical population thresholds for a subset of Puget Sound chinook populations: North Fork Nooksack, South Fork Nooksack, Upper Skagit summer, Lower Skagit fall, Lower Sauk summer, North Fork Stillaguamish, South Fork Stillaguamish and Green River fall (Table 5). These thresholds were used in calculating Rebuilding Exploitation Rates (RERs) for these populations. RERs were used in making jeopardy determinations for fisheries taking listed Puget Sound chinook (NMFS 1999, 2000b). Critical thresholds ranged from 200-400 for small populations and 835-967 for large populations. Viable thresholds ranged from 300-1,250 for small populations and 5,523-7,454 for large populations (Table 5). The RMP low escapement thresholds are consistent with NMFS' RER thresholds and meet or exceed the VSP guidelines for populations in similar size categories. The RMP spawning escapement thresholds also generally meet or exceed NMFS' RER escapement thresholds and VSP guidance for populations in similar size categories (Table 4). The spawning escapement threshold for the Skagit summer/fall Management unit is lower than the combined viable thresholds associated with NMFS' RER for the Skagit summer/fall populations. Whether or not it is consistent with VSP criteria depends in part on the population structure of the management unit. More importantly, a retrospective analysis conducted by NMFS of the RMP management approach for the Skagit summer/fall management unit indicated that, regardless of the final delineation, NMFS' RER thresholds for each of the individual Skagit summer/fall populations would be met or exceeded 65-100% of the time.

The thresholds will be re-examined should the Puget Sound and Olympic Peninsula TRT conclude the population structure of Puget Sound chinook differs from the RMP delineation.

Table 4. Natural Chinook Management Units and Associated Thresholds

Natural Chinook Management Units	Spawning Escapement Threshold	Low Escapement Threshold
Western Strait Hoko	850 spawners ¹	500 spawners (c)
Elwha River	2,700 spawners ²	1,000 spawners (c)
Dungeness	925 spawners ³	500 spawners (c)
Mid-Hood Canal	750 spawners ⁴	400 spawners (n)
Skokomish	3,150 aggregate ⁵ / 1,200 natural spawners	1,300 aggregate/ 800 natural spawners (c)
Nooksack Early North Fork	2,000 spawners ⁶	1,000 spawners (n)
South Fork	2,000 spawners ⁶	1,000 spawners (n)
Skagit Spring Chinook	320 spawners ⁷	576 spawners (n)
Skagit Summer/Fall Chinook	4,700 spawners ⁸	4,800 spawners (n)
Upper Skagit		2,200 spawners (n)
Lower Skagit		900 spawners (n)
Upper Sauk		400 spawners (n)
Stillaguamish Summer/Fall North Fork	2,000 spawners ⁹	500 spawners (n)
South Fork		
Snohomish Summer/Fall Snoqualmie	5,250 spawners ⁹	2,000 spawners (n)
Skykomish		582 spawners (n)
Bridal Veil		621 spawners (n)
Wallace		327 spawners (n)
		data unavailable
Lake Washington Chinook Cedar River Index	1,200 spawners ¹⁰	200 spawners (n)
Green River Chinook	5,800 spawners ⁹	1,800 spawners (c)
White River Spring Chinook	1,000 spawners ¹¹	200 spawners (c)
Puyallup River Chinook South Prairie Index	500 spawners ¹²	500 spawners, full system (c)
Nisqually River Chinook	1,100 spawners ¹³	500 spawners (c)

(n) – low abundance measures as natural origin recruits

(c) - low abundance measures as composite of natural and hatchery returns

1) Ames and Phinney 1977. Original goal modified to exclude capture of adults for supplementation program.

2) Ames and Phinney 1977. This objective is a composite escapement of natural and hatchery returns. Hatchery is listed as essential to recovery.

3) Smith and Sele 1994.

4) Hood Canal Salmon Management Plan - Point No Point Treaty Council et al.1986.

5) Ames and Phinney 1977. This represents a composite goal, a targeted hatchery return of 1500 adults is now included.

6) NEAT Recovery Plan - In preparation. These numbers reflect natural origin spawners.

7) Washington Department of Fisheries 1977. These estimates are generated from redd counts versus earlier estimates which are extrapolated from peak live and dead counts.

8) R. Hayman 1999.

9) Ames and Phinney 1977.

10) Hage et al. 1994.

11) WDFW et al. 1996. Interim goal, represents 1,000 natural spawners passed over Mud Mountain Dam.

12) Puyallup River Fall Chinook Recovery Plan – in preparation. Escapement estimates are based on redd counts in even-numbered years and AUC estimations converted to redd-based projections in odd-numbered years due to pink salmon spawning.

13) The Nisqually EDT Work Group 1999.

Table 5. Critical and viable escapement thresholds associated with NMFS' Rebuilding Exploitation Rates (RERs)

ESU	Population	Escapement Thresholds		Recovery Exploitation Rates	
		Critical	Viable	CWT RER	FRAM RER
Puget Sound	NF Nooksack	200	1,250	24%	17%
	SF Nooksack	200	1,250	30%	21%
	Upper Skagit/S	967	7,454	54%	60%
	Lower Skagit/F	251	2,182	33%	49%
	Lower Sauk/S	200	681	36%	51%
	NF Stillaguamish/S	300	552	45%	32%
	SF Stillaguamish/	200	300	28%	24%
	Snoqualmie	400	2,325	32%	32%
	Skykomish	300	1,600	34%	34%
	Bridal Veil	200	NA	NA	NA
	Green River S/F	835	5,523	62%	53%

Population Growth Rate (Productivity)

Productivity is driven by habitat quality and reproductive fitness, not only by fishery actions. However, harvest management objectives must be appropriate to the habitat capacity and productivity experienced by the individual populations. Although the Puget Sound chinook RMP includes no explicit management objectives for productivity, the interim viable thresholds and exploitation rates are based on current survival and productivity rates with adjustments to account for data uncertainty and management imprecision. By ensuring harvest management objectives are consistent with current environmental conditions, and accounting for known sources of error, fisheries are not expected to impede recovery.

As part of the scheduled RMP evaluation, management objectives will be revised as necessary to reflect changes in environmental conditions. The intent is to increase spawners in concert with the recovery of the system's productivity and capacity resulting from habitat restoration efforts,

thereby annually providing sufficient escapement to enable the management unit to generate maximum surplus under progressively improving habitat conditions. In this way, harvest is linked to recovery efforts in the other Hs (habitat, hatcheries and hydro-modification), ensuring that all actions are working together to achieve recovery.

The Co-managers are in the process of developing management unit-specific recovery goals for productivity based on an analysis of each watershed's physical habitat parameters functioning under optimal conditions, expressed as spawner to smolt survival rates and adult recruits per spawner. This work is expected to be completed sometime in 2001 (J. Scott, Shared Strategy Conference, January 19, 2001).

Spatial Structure

It is possible for fisheries to affect the spatial structure of a population and/or ESU. For example, a fishery could target a certain portion of the run, which may result in a substantial decrease in the number of spawners destined to a particular spawning location or population through time. The early portion of a run of salmon may be the fish that migrate the furthest upstream. If the fishery harvests the early returns, the spawning distribution of a population may change.

In Puget Sound, fishing-related mortality is relatively constant across all population segments and life histories within the ESU. When possible, the Co-managers shape fisheries to harvest throughout the run timing of the returning adults. However, when harvest must be reduced, fishing-related mortality on chinook are reserved for incidental by-catch in fisheries directed at other species. This may concentrate fishing-related mortality on the extreme ends of the run timing. Sixty-five percent or more of chinook caught in Puget Sound are caught in mixed-stock fisheries, and in terminal fisheries directed on hatchery populations (FRAM 0800 2000). In these fisheries, harvest generally occurs throughout the migration of the returning chinook. In terminal areas where chinook are caught incidentally to fisheries directed on other species, harvest probably effects 10-15% or less of the run on either end of the run timing. There is currently no information to indicate that this is having deleterious effects to certain segments of the populations, and certainly not to the ESU as a whole. For example, NMFS status review (Myers et al. 1998) did not note any trends in size, weight, fecundity or other life history traits for Puget Sound chinook that might be a result of fishing activities. If, however, deleterious effects are detected, the RMP commits to taking appropriate measures. Section H below examples of the types of measures that would be taken. More extensive escapement surveys might provide a way to monitor changes in the use of spawning areas by returning adults.

The loss of historic habitat has contributed to the loss of the spatial integrity of chinook populations more than any other factor. Puget Sound chinook habitat has been significantly degraded through a variety of causes (Bishop and Morgan 1996, PSSRG 1997). Loss of large woody debris, urbanization, diking, water withdrawals, hydro development, changes in flow conditions have all contributed to the loss and degradation of spawning, early incubation and

winter rearing habitat for chinook. For example, hydro-modification in the Skagit system has resulted in a loss of 64% of its distributary sloughs and 45% of side channel sloughs. Habitat restoration will be necessary to address the current spatial structure deficiencies within the ESU.

Diversity

As stated above, the fisheries in the RMP will likely reduce any potential effects of within- and among- population diversity of the ESU. These management units represent the breadth of life history and geographic distribution in the ESU. The fifteen natural management units identified in this plan represent the full complement of the natural chinook populations within Puget Sound and include all principal life history traits (spring, summer and fall runs). Managing for the current array of natural management units preserves the spatial and temporal distribution of natural chinook runs throughout the region. The co-manager's intent is to provide for the conservation of each natural management unit, which in turn conserves the region's diversity of life history and genetic traits.

The fisheries will not likely impact one portion of the run more than any other. For those management units comprised of multiple populations, fisheries are managed for the aggregate exploitation rate and, in most cases, to ensure that each population within the management unit meets or exceeds its escapement thresholds. These management units represent the breadth of life history and geographic distribution in the ESU.

The Puget Sound chinook RMP represents significant changes in chinook management for several regions of Puget Sound. Chinook populations in South Puget Sound and Hood Canal (Table 3), representing about 20% of the natural production in Puget Sound, had been managed primarily for hatchery production, with natural escapement as a secondary goal. The RMP includes natural escapement objectives for all established naturally spawning Puget Sound chinook populations, including those in South Puget Sound and Hood Canal, protecting the entire diversity of the ESU.

Diversity parameters are most likely influenced by habitat and hatcheries for most Puget Sound chinook populations. Hatchery and Genetic Management Plans (HGMPs) are under development for all Puget Sound hatchery facilities impacting listed chinook. In setting recovery goals, the Co-managers intend to express diversity goals as a percentage of life history variants that are viable (i.e., with greater than a 1:1 recruit/spawner ratio on the average), desired spawner age composition, and spatial/temporal run distribution. These goals will be incorporated into the management approach upon completion (current completion expected in 2001).

(C) Sets escapement objectives or maximum exploitation rates for each management unit or population based on its status, and assures that those rates or objectives are not exceeded.

Exploitation rate ceilings and low abundance thresholds are identified for most management units (Table 6). Although fisheries may be managed for exploitation rates lower than the ceilings in any one year, the rates may not be exceeded. Some management units are managed to achieve an escapement goal in the terminal areas. The general approach to setting exploitation rate ceilings described in the RMP is risk averse in that it is designed to provide high probabilities of survival and recovery. Harvest at the targeted exploitation rate:

- *“will not increase the probability of the management unit falling below the critical abundance threshold, in 25 years, by more than 5 percentage points than if the exploitation rate were modeled as zero;*
- *assures an 80% probability of the management unit exceeding the recovery [viable] escapement level³ in 25 years.”*

For each management unit, exploitation rate objectives are developed that reflect the current productivity of its associated populations. A simulation model was used to project escapements of the management unit or population over a 25-year period under a range of exploitation rates. The simulations included variability in data estimates, management error and survival conditions. The exploitation rate objectives were then set to meet the above criteria based on the simulation results. To date, the Co-managers have completed this analysis for only a subset of the Management units: Skagit summer/fall, Skagit spring, Stillaguamish summer/fall and Snohomish summer/fall. Analysis specific to the derivation of exploitation rates for these management units are detailed in Appendix A of the RMP. In the long-term, the Co-managers intend to develop exploitation rates using this approach for the remainder of Puget Sound chinook Management units as data becomes available.

For those management units where adequate data were not available to assess recent productivity, or analysis has not yet been completed, a recent year (1998-2000) or an average of recent years' exploitation rates were adopted as the objective (Nooksack early, Puyallup and White River management units). Those management units whose harvest now occurs predominantly outside of Washington waters are managed for southern U.S. (SUS) exploitation rate objectives (Western Strait of Juan de Fuca, Elwha, Dungeness, Mid-Hood Canal). For the Lake Washington, Green River Nisqually, River and Skokomish River⁴ management units, pre-terminal rates will be fixed and terminal fisheries will be managed to achieve the natural spawner escapement goal based on

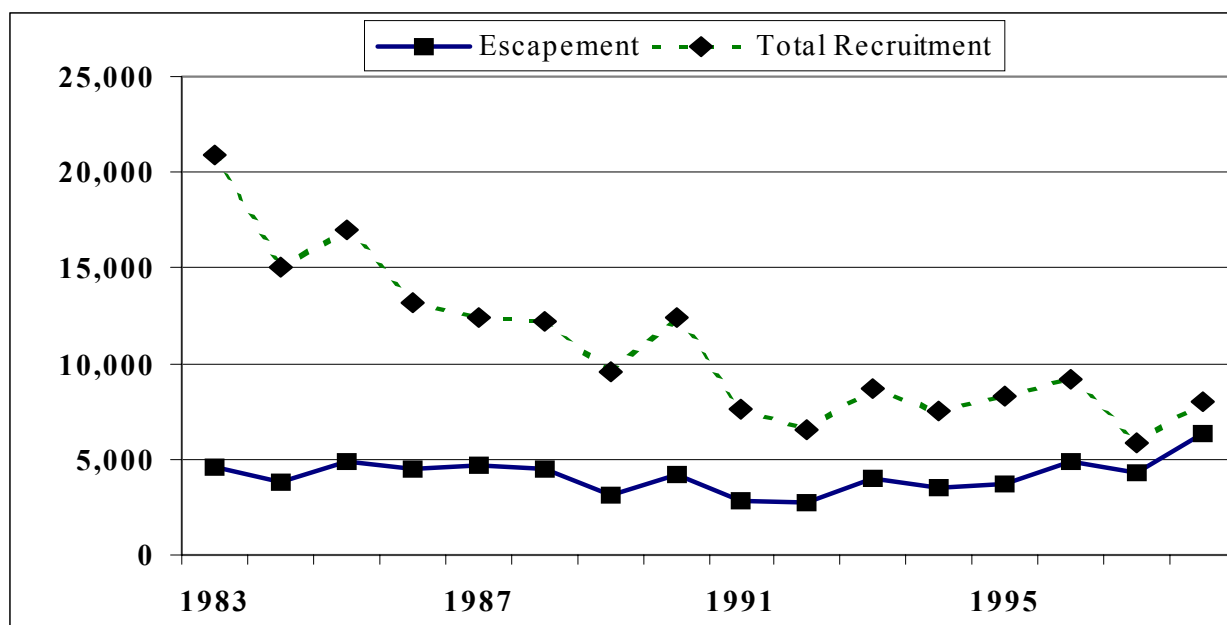
³ For Skagit, the recovery escapement level is the escapement above which there is < 1% probability that the unit will go extinct in 100 years, under existing conditions. The “recovery escapement level” should not be confused with the “recovery goal” which will take into account desired habitat condition.

⁴ Inseason update under development. Terminal fisheries will be managed for preseason expectations of escapement until update is finalized.

inseason updates. Total exploitation rates have been stable at low levels in recent years, although variable due to internal Canadian conservation issues. In the near-term, these management actions are expected to continue in Canadian fisheries. Harvest of Puget Sound stocks in Alaskan fisheries is negligible, nevertheless, it is constrained by the terms of the Pacific Salmon Treaty agreement signed in 1999, and found to be no jeopardy by NMFS under a section 7 consultation (NMFS 1999). Directed harvest of Puget Sound chinook has been increasingly constrained in recent years, and, as abundance has continued to decline, the Co-managers have taken further management measures to minimize incidental harvest. These increasingly restrictive measures have contributed to more stable spawning escapement even though the total recruitment has continued to decline (Figure 2).

In any year, should management units or associated populations fall below or be projected to fall below their low abundance thresholds, Southern U.S. exploitation rates will be reduced to those consistent with Appendix C of the RMP. The Co-managers may also take further actions as necessary (see section H below for examples of the types of actions that would be taken). Management units which are currently at or below their low abundance thresholds have already been reduced to Appendix C levels (Elwha, Dungeness, Mid-Hood Canal, Lake Washington). The results of the annual post-season reports will also be used to shape fisheries in order to increase the effectiveness of the regime and decrease uncertainty. Escapements will be monitored to evaluate whether these low exploitation rates have continued to help stabilize escapements.

Figure 2. Comparison of time series of escapement with total recruitment for Snohomish chinook.



As discussed previously, NMFS has developed RERs for most of the Category 1 populations for which information is available. The objectives proposed in the RMP are consistent with the RERs developed so far with one potential exception. As mentioned earlier, exploitation rates derived from direct measures of fishing-related mortality, e.g., coded-wire tags (CWTs), have been translated into values that could be easily compared with output from models used for domestic harvest management, i.e., FRAM. The RMP exploitation rate of 54% for the Skagit summer/fall management unit as derived from CWTs (Appendix A of RMP) is consistent with the RER for the Upper Skagit summer population, but is higher than the RERs for the Lower Skagit fall (33%) or Upper Sauk summer (36%) populations. However, whether the RMP exploitation rate for the Skagit summer/fall exploitation rate is really different from NMFS' RERs again depends in part on the population structure of the management unit which is currently under consideration by the Puget Sound and Olympic Peninsula TRT. If the management unit is a single population, the proposed RMP rate is consistent with NMFS' RER, if the management unit is two or three populations, then there will be a difference. How large that difference is will depend on the Puget Sound and Olympic Peninsula TRTs final population delineation and the role of each population in the recovery of the ESU. The thresholds and exploitation rates will be re-assessed based on the results of the TRT analysis.

In the meantime, the FRAM equivalent exploitation rate proposed by the Co-managers of 52% is conservative, and just slightly higher than the FRAM equivalent NMFS RERs for the Lower Skagit (49%) and Upper Sauk (51%) (Table 4). A retrospective analysis also indicates that the RMP exploitation rate for the Skagit summer/fall Management unit, in combination with management for the low abundance thresholds of the other two Skagit summer/fall populations will result in escapements above NMFS viable thresholds for all three populations 65% or more of the time and none of the three populations fall below NMFS' critical threshold. Should the fisheries not harvest up to the exploitation rate ceilings, as has been the case in recent years, the frequency above the viable threshold would be expected to increase.

The use of exploitation rates rather than fixed escapement goals for most Puget Sound chinook populations will allow the possibility for large run sizes, which are needed to explore population productivity and habitat capacity. Rather than always harvesting down to escapement when abundance is high, a portion of the run size is always allocated to escapement regardless of run size. Most importantly, an exploitation rate approach is more resilient to data uncertainty and environmental variability than a fixed goal approach.

Table 6. Natural Chinook Management units and Associated Objectives

Natural Chinook Management Units	Recovery Exploitation Rate Ceiling¹	Appendix C Expected Exploitation Rate	Low Abundance Threshold²
Western Strait Hoko	10% SUS ER ³	8-10% SUS ER	500 spawners (c)
Elwha River	10% SUS ER ³	8-10% SUS ER	1,000 spawners (c)
Dungeness	10% SUS ER ³	8-10% SUS ER	500 spawners (c)
Mid-Hood Canal	15% pre-terminal SUS ER ³ Terminal – 750 spawners (≤15% SUS)	13-15% pre-terminal SUS ER+terminal (≤ 15% SUS)	400 spawners (n)
Skokomish	15% pre-terminal SUS ER Terminal – 3,150 spawners	12-15% pre-terminal SUS ER+terminal	1,300 spawners/ 800 natural spawners (c)
Nooksack Early North Fork South Fork	The Co-managers and NMFS are developing a RER assessment for this stock ⁴	5-7 % SUS	1,000 spawners (n) 1,000 spawners (n)
Skagit Spring	42% Total ER	15-17% SUS or 21-23% Total ER	576 spawners (n)
Skagit Summer/Fall	52% Total ER	12-17% SUS or 29-33% Total ER	4,800 spawners (n)
Stillaguamish Summer/Fall	25% Total ER	9-10% SUS or 15-16% Total ER	500 spawners (n)
Snohomish Summer/Fall	32% Total ER	19-20% SUS or 24-26% Total ER	2,000 spawners (n)
Lake Washington Cedar River Index	15% pre-terminal SUS ER Terminal – 1,200 spawners	11-15% pre-terminal SUS ER+terminal	200 spawners (n)
Green River	15% pre-terminal SUS ER Terminal – 5,800 spawners	10-15% pre-terminal SUS ER+terminal	1,800 spawners (c)
White River Spring	17% Total ER	12% SUS or 13% Total ER	200 spawners (c)
Puyallup River	50% Total ER	26% SUS or 36% Total ER	500 spawners (c)
Nisqually River Chinook	1,100 spawners	Terminal actions taken to achieve 1,100	500 spawners (c)

(n) – low abundance measures as natural origin recruits

(c) - low abundance measures as composite of natural and hatchery returns

1) Interim management ceiling during recovery phase expressed in FRAM values.

2) Level of forecasted spawning abundance that triggers additional management action

3) FRAM exploitation rate measured as total exploitation rate in southern U.S. fisheries.

4) In the interim, management guidance will be derived from Appendix C application.

(D) Displays a biologically based rationale demonstrating that the harvest management strategy will not appreciably reduce the likelihood of survival and recovery of the ESU in the wild, over the entire period of time the proposed harvest management strategy affects the population, including effects reasonably certain to occur after the proposed actions cease.

The implementation of this approach preserves the existing diversity and spatial structure of natural populations within Puget Sound. Management objectives based on natural production or natural spawning have been established for all Category 1 and 2 management units and their associated populations and captures the full range of genetic diversity and life history traits exhibited by the natural chinook populations within Puget Sound. Maintenance of management units as aggregates of healthy, self-sustaining populations will ensure the diversity necessary for continuing the long-term productivity of Puget Sound chinook salmon, thereby, conserving the evolutionary legacy of the Puget Sound ESU for chinook salmon as a species. The subset of Puget Sound chinook with completed management unit-specific productivity analysis (Skagit spring, Skagit summer/fall, Snohomish summer/fall, Stillaguamish summer/fall) and those routinely achieving their long-term spawning escapement goals represent a cross section of these life history traits and 75% of the natural production within Puget Sound (1992- 1996).

This management approach further enhances the probability of survival and recovery of Puget Sound chinook by being responsive to low population status. Minimum spawning escapement levels have been established for each management unit and its associated populations. These low abundance thresholds are established to safeguard against declines to the point of population instability. They significantly exceed the VSP guidelines for many of the populations. When spawning escapement is projected to fall at or below the low abundance thresholds, additional fisheries management measures are triggered to conserve these management units and associated population (Appendix C of the RMP). Management units currently near or below their low abundance are already being managed at these levels. Reductions to these levels appear to have contributed to stabilization of escapements in recent years for most populations.

The long-term approach used to determine exploitation rates objectives is conservative, provides quantitative measures of survival and recovery, and isolates the effect of harvest. This approach is important in ensuring that harvest actions do not impede recovery regardless of the effects of the other Hs, and as importantly, that the treaty and non-treaty fishermen do not bear the burden of conservation beyond the effects of their actions. These objectives represent exploitation rate ceilings. Actual exploitation rates have been below them in most recent years. However, some caution is warranted since exploitation rates using this approach have yet to be completed for several of the Category 1 and 2 populations in the ESU for which data is available. These should be completed within the next couple of years.

The proposed objectives are generally consistent with NMFS' RER population standards previously used to assess likelihood of survival and recovery of the Puget Sound ESU. These standards included an assessment of the long-term effects of exploitation rates at these levels.

Implementation of the approach in the RMP represents significant changes in Puget Sound harvest management practices, and is expected to significantly reduce or eliminate harvest as a factor of decline of the Puget Sound chinook ESU. In previous years, significant portions of Puget Sound were managed for hatchery production objectives. The RMP establishes management objectives for all Category 1 and 2 management units and associated populations based on natural production or natural spawning objectives. Exploitation rates on Puget Sound chinook populations during 1983-1996 averaged 27-83%⁵ (8-51% SUS) depending on the management unit. Exploitation rates since the chinook status review was completed, 1997-2000, have averaged 20-68% (6-61% SUS), a reduction of 30-55%. The RMP rates are at or below those observed in recent years. Declines in exploitation rates have contributed to stabilized or increasing escapements observed for many populations.

The RMP approach to establishing management objectives is risk averse and progressive, representing significant improvements from past management practices: (1) Management objectives based on natural production and natural spawning have been established for the majority of Category 1 populations and all of the Category 2 populations for which data is available. These management units represent the entire range of life history types (races) and geographic distribution that comprise the Puget Sound ESU; (2) It derives exploitation rates based on conservative, quantifiable standards directly related to recovery, and incorporates uncertainty; (3) In isolating the effect of harvest on survival and recovery, the approach is valuable in ensuring that harvest actions do not impede recovery, regardless of the contribution of the other Hs. At the same, the approach is linked to the other Hs by taking into account current environmental and habitat conditions. The TRT results are expected to address some of the current uncertainties in management objectives as they relate to population structure. The most depressed populations must be monitored closely to evaluate whether they are improving or continuing to remain stable. If the populations continue to decline, further harvest actions may be considered, but at these low rates, it is uncertain whether additional harvest restrictions would provide significant benefit to the population. The inclusion of new information through monitoring and evaluation (see section F below) provides greater assurance that objectives will be achieved in future seasons. The Co-managers have committed to taking additional actions (see section H below) ensure that salmon fishing-related mortality is consistent with exploitation rate and escapement objectives.

⁵ As measured by the Fisheries Regulation and Assessment Model (FRAM), the primary model used in assessment of Puget Sound and Washington ocean fisheries.

(E) Includes effective (a) monitoring and (b) evaluation programs to assess compliance, effectiveness, and parameter validation (*Minimum requirement: collect catch and effort data, information on escapements, and information on biological characteristics, such as age, fecundity, size and sex data, and migration timing*).

Section V and Appendix D describe the monitoring programs in place to assess effectiveness of the management actions in achieving the management objectives of the RMP and to validate the assumptions used in deriving the objectives. This information is used in conjunction with the Performance Indicators to assess effectiveness of the RMP. The monitoring programs are comprehensive in nature. Catch and effort, and population distribution information is collected from all commercial fisheries through catch sampling and catch sales receipts ("fish tickets"). The same information is collected from sport fisheries through stratified sampling of fisheries, creel surveys and voluntary return of catch record cards. Escapement surveys provide information on run timing and population status. However, in most areas, the current methods of escapement estimation were not designed to provide estimates of total spawning population size, but rather to indicate trends in spawning abundance (Smith and Castle 1994). With changes in the use of escapement estimates, the approach to escapement estimation should be reassessed and revised to provide the most accurate information for which the data is being used. Catch sampling and escapement surveys also provide biological data on age, length, sex, and size. Depending on the accuracy required of such estimates, more sampling effort may be required than has previously been expended on gathering basic biological data to determine age and sex composition. State and tribal technical staff are currently focusing attention on the design and implementation of these studies.

The performance of fisheries will be assessed annually to determine the extent which catch and fishing effort conform to the quotas, ceilings, or projections that were defined in pre-season planning for each fishing area and season. Incidental and non-landed catch make up an important component of this accounting. This assessment leads to further evaluation of the effectiveness of fisher regulations, (i.e. time or area constraints, gear restrictions, or bag limits). The causes of significant discrepancies between expected and actual catch and effort will be identified with a view to changing regulatory measures, and methods for projecting catch and fishing effort, to improve their accuracy.

The annual abundance of chinook returning to each management unit will also be estimated to monitor the status of populations and to assess the accuracy of forecasts. Terminal-area harvest and spawning escapement will provide the earliest hard evidence of unit abundance. The spawning escapement of each population will be compared to the pre-season expectation, in most cases prior to planning the next fishing season. Assessment of the total annual return requires accurate estimation of escapement and reconstruction of fishing-related mortality from coded-wire tag data or fishery simulation models. There will a time lag of approximately 18 months, after the conclusion of the fall fishing regime, before tag data are available. Tag recoveries from

all intercepting fisheries – including those in Alaska, British Columbia - are required for this assessment. Accounting of the fishing-related mortality and escapement of each management unit will enable the calculation of exploitation rates, which may be compared with the pre-season projections and objectives. Ultimately, reconstruction of all cohorts associated with a given brood year enables the calculation of brood-year exploitation rates.

Cohort reconstruction and estimation of exploitation rates from tag data will also provide a means of assessing the accuracy of fishery simulation models. Models predict unit-specific fishing-related mortality by scaling the abundance of all contributing populations, and the fishing effort anticipated in each area and season, against those in a base period. Tag-based run reconstruction provides an alternative and independent estimate of the total harvest fishing-related mortality and harvest distribution of each management unit. The errors detected in the simulation model, whether they be associated with abundance forecasts or computation of harvest, will be quantified so that fishery management planning will be robust to those errors.

Cohort reconstruction for each management unit is the fundamental monitor of productivity. As discussed above, the productivity (i.e. freshwater and marine survival) of each unit guides the development and adjustment of exploitation rate objectives. Those objectives must conform with the most recent values and trends in population productivity. However, it takes longer to collect sufficient data on productivity to detect changes in productivity. Periodically, the population / recruit function will be updated, and the recovery exploitation rate and thresholds re-assessed, for each management unit.

The availability of requisite data, and the schedule for completing each aspect of monitoring harvest management effectiveness, are described in detail in Appendix D. Harvest monitoring and fishery sampling protocols are described there in the context of their application to management. The tasks involved in monitoring abundance and productivity, and assessing the performance of annual fishing regimes, are mandated by the Puget Sound Salmon Management Plan.

In addition to the monitoring programs discussed in the RMP, there are numerous other ongoing projects funded by other agencies or programs which provide additional information useful for fisheries management. Each year, the Salmon Recovery Funding Board (SRF) provides funding for projects designed to further salmon recovery. Limiting factor analyses are being conducted for each major watershed within Washington State (Washington State Conservation Commission 2000). The results of these analyses will be important in parameter validation and management objective revision as necessary. Data collection and monitoring programs included in Hatchery and Genetic Management Plans will also provide valuable information on stray rates and patterns, and contribution of hatchery fish to escapements.

(F) Provides for (a) evaluating monitoring data; and (b) making any revisions of assumptions, management strategies, or objectives that data show are needed to be made.

Section V, and Appendix E describe how WDFW and the Puget Sound tribes will evaluate the monitoring data, compile a report of the findings and incorporate those findings on an annual basis. Appendix F provides an outline of the post season report which will include biological and fishery information from the previous year and an assessment of how the fisheries performed with respect to the objectives and guidelines established in the RMP.

State and tribal technical staff will meet periodically during the year, exchange information and data, achieve consensus on in-season management actions, and prepare reports, consistent with the schedule in Appendix E. Additional meetings and exchanges will occur as needed to develop recommendations for management regimes pertinent to this plan, resolve differences in approach and review monitoring program results. Data from the monitoring programs form the basis for development and refinement of forecasting and assessment efforts.

Post-season review is part of the annual pre-season planning process. This post-season review is necessary to permit an assessment of the parties' annual management performance in achieving spawning escapement, enhancement, harvest, and allocation objectives. The Co-managers review population status annually and where needed, identify actions required to improve estimation procedures, and correct bias. As appropriate, measures will be derived to address deleterious effects on size, age or sex selectivity. Such improvements provide greater assurance that objectives will be achieved in future seasons. This effort builds a remedial response into the pre-season planning process to prevent excessive fishing-related mortality levels relative to the conservation of a management unit.

These reports will be completed in February of each year. In addition, a comprehensive review of the RMP is scheduled to occur in 2006 (the first complete brood cycle after implementation of the RMP) to evaluate whether the fisheries and populations are performing as expected (effectiveness and compliance), incorporate new information and verify assumptions (parameter validation). The review of the harvest management plan will include, but will not be limited to population structure, recovery goals, management objectives, application, and monitoring. It will also include consideration of the information developed through the formal recovery planning efforts by the Technical Recovery Teams. Revisions will occur if the comprehensive technical review of the available information indicates that a modification would be beneficial to achieving the goals of the RMP.

(G) Provides for (a) effective enforcement, (b) education, (c) coordination among involved jurisdictions.

The WDFW and each tribe is responsible for regulation of harvest in fisheries under its regulatory authority, consistent with the principles and procedures set forth in the Puget Sound Salmon Management Plan. All fisheries shall be regulated to achieve sharing and production objectives based on four fundamental elements: (1) acceptably accurate determinations as to the appropriate exploitation rate, harvest rate, or numbers of fish available for harvest; (2) the ability to evaluate the effects of specific fishing regulations; (3) a means to monitor fishing activity in a sufficient, timely and accurate fashion; and (4) effective regulation of fisheries to meet objectives for spawning escapement and fishing-related mortality. The Co-managers maintain a system for transmitting, cross-indexing and storing fishery regulations affecting harvest of salmon. Both WDFW and the Puget Sound Tribes monitor and enforce compliance with these regulations as part of more extensive enforcement programs. The Co-managers' and federal court systems should be sufficient to ensure that enforcement is followed through with appropriate prosecution of violators.

The Puget Sound treaty tribes and Washington Department of Fish and Wildlife have direct management authority over fisheries harvesting Puget Sound chinook in Puget Sound. The annual Pacific Salmon Commission, Pacific Fisheries Management Council and North of Falcon meetings provide the forums for coordination among jurisdictions impacting Puget Sound chinook populations. The fishery regimes developed each year as part of these planning forums account for fishing-related mortality in all fisheries in the United States and Canada, one aspect of which is to ensure that fisheries are consistent with the management objectives and approach described in the Puget Sound chinook RMP. Consistent with this aim, the RMP states that, "...the Co-managers will submit the recovery exploitation rate objectives for the Puget Sound chinook management units to the Pacific Fishery Management Council for inclusion into the annual federal management plan for West Coast salmon."⁶ Fishing-related mortality of Puget Sound chinook in Canadian and Alaskan fisheries are constrained by the terms of the current Pacific Salmon Treaty agreement (NMFS 1999, PST 1999).

Both the Pacific Fisheries Management Council and North of Falcon planning processes are open to the public. The Council takes public comment and input throughout its development of fishing regimes for the ocean fisheries off Washington, Oregon and California. Representatives from the commercial and sport fishing constituencies are active participants in the North of Falcon planning process. Public notification of fishery regulations is achieved through press releases, regulation pamphlets, telephone hotlines, and federal register notices. The WDFW has

⁶ These objectives will be revised again when recovery goals are established

recently implemented a more aggressive campaign to increase public involvement and education through expanded public meetings, and greater access to information through use of the Internet.

(H) Includes restrictions on resident and anadromous species fisheries that minimize any take of listed species, including time, size, gear, and area restrictions.

The exploitation rate and escapement objectives are the primary elements of the harvest plan. Time, size, gear and area and retention restrictions are all among the actions taken to ensure that salmon fishing-related mortality is consistent with exploitation rate and escapement objectives. Chinook are taken incidentally in fisheries directed at other species in most areas of Puget Sound. Fisheries become increasingly restricted as abundance falls, and Co-managers have committed to closing remaining fisheries entirely in several areas if abundance is not projected to meet escapement thresholds (see Appendices A and C of the RMP). Chinook directed fisheries in many terminal areas have been closed for years, and in other areas, fisheries on other species and healthy hatchery populations are significantly restricted or delayed to protect naturally spawning chinook. Among other actions designed to protect listed species and populations of concern, sport fisheries have implemented April-June closures and size limits to protect spring chinook, closed spawning grounds to fishing, and required non-retention of chinook. Both commercial and sport fisheries have instituted closures around river mouths where chinook concentrate before moving upstream. A FMEP is currently under development by WDFW for resident fisheries in Puget Sound impacting listed species.

Juvenile spring chinook emigrating from freshwater are not typically vulnerable to being caught because of their feeding habits and small size. These juvenile chinook salmon are rarely caught in any Puget Sound fishery. Pre-recruit juveniles, typically two-year olds commonly referred to as “blackmouth”, may be caught in sport and commercial fisheries. Sport fisheries in areas throughout Puget Sound have regulations that will reduce the potential mortality to juvenile chinook such as use of barbless hooks, minimum size requirements and catch and release only fishing. Puget Sound freshwater salmon sport fisheries are concentrated during the period of adult return (July-October) well after the majority of juveniles have emigrated from freshwater. The RMP management objectives and annual estimates of fishing-related mortality include mortality on pre-recruit juveniles as well as maturing adults.

(I) Is consistent with other plans and conditions established within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.

The RMP explicitly states in its general principles that it will comply with the requirements of U.S. v. Washington and other applicable federal court orders. Puget Sound fisheries are managed by the State of Washington and the Puget Sound treaty tribes pursuant to the Puget Sound Salmon Management Plan (PSSMP) which was adopted by court order as a sub-proceeding related to U.S. v. Washington (384 F. Supp. 312 (W. D. WASH. 1974)). The

purpose of the PSSMP is to establish guidelines for management of salmon and steelhead resources originating in Puget Sound. The PSSMP applies to all marine and freshwater fisheries in Puget Sound from the Strait of Juan de Fuca eastward.

Notice of Recommended determination

As required in (6)(iv) of section 223.203 of the 4(d) Rule for Puget Sound chinook, the Secretary will publish notice of his determination as to whether the RMP appreciably decreases the likelihood or survival and recovery of affected threatened ESUs, together with a discussion of the biological analysis underlying that determination.

RECOMMENDED DETERMINATION

As evaluated above, NMFS Sustainable Fisheries Division (NMFS-SFD) recommends a determination that the RMP for Puget Sound chinook provided by WDFW and the Puget Sound Treaty Tribes adequately addresses all of the criteria established for a RMP under Limit 6 of the 4(d) Rule. However because of the need for more information by NMFS and the Co-managers, NMFS-SFD recommends applying the take limit to the RMP for two years at which time the RMP will be reassessed. Fisheries would be implemented in accordance with the approved RMP through April 30, 2003. At that time, NMFS would determine whether the information gaps had been addressed sufficiently in the interim to extend application of Limit 6.

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